UNITED STATES DISTRICT COURT
DISTRICT OF MAINE

FRIENDS OF MERRYMEETING BAY and
ENVIRONMENT MAINE,

Plaintiffs,

v.

C.A. No. 1:11-cv-00038-GZS

NEXTERA ENERGY RESOURCES, LLC;
NEXTERA ENERGY MAINE OPERATING
SERVICES, LLC; FPL ENERGY MAINE
HYDRO, LLC, and THE MERIMIL
LIMITED PARTNERSHIP,

Defendants.

DECLARATION OF DR. JEFFREY A. HUTCHINGS IN SUPPORT OF PLAINTIFFS' MOTION FOR PRELIMINARY INJUNCTION

I, Dr. Jeffrey A. Hutchings, declare as follows:

Qualifications

1. I am currently the Killam Professor of Biology at Dalhousie University in Canada and a Professor II at the University of Oslo in Norway. My research focuses on life history, evolution, population ecology, genetics, and conservation biology of fishes. After receiving my doctorate in Evolutionary Ecology from Memorial University of Newfoundland (Canada) in 1991, I undertook postdoctoral research at the University of Edinburgh (Scotland) and at the Department of Fisheries and Oceans, St. John's, Newfoundland. I have published more than 165 research papers in the peer-reviewed, primary scientific literature. Since 1999, I have served on the editorial boards of six national and international peer-reviewed scientific journals. From 2006-2010, I chaired Canada's national science advisory body responsible, by federal statute, for assessing the risk of extinction of Canadian species and populations (the Committee on the

Status of Endangered Wildlife in Canada, COSEWIC). I am President of the 1000-member Canadian Society for Ecology and Evolution (2012-2013). And, from 2009 to 2012, I chaired a Royal Society of Canada expert panel studying the effects of climate change, fisheries, and aquaculture on Canadian marine biodiversity, including Atlantic salmon.

2. The Atlantic salmon is a species I have studied for thirty-one years, beginning with research in Newfoundland in 1982. My experiences working on scientific issues pertaining to the conservation biology of Atlantic salmon include the following: I was an invited speaker at the inaugural *International Conference on Interactions Between Wild and Cultured Atlantic Salmon* held in Loen, Norway, in April, 1990. Since 1995, I have been regularly invited by the Canadian Department of Fisheries & Oceans (DFO) to serve as a reviewer of stock assessments for Atlantic salmon in the Maritimes and Newfoundland. In 1996, I was a Canadian member of the Canada/U.S. Genetics Subgroup of the *Scientific Working Group on Salmonid Introductions and Transfers*, formed by NASCO (North Atlantic Salmon Conservation Organization). In 1998, I served as a member of two DFO-sponsored, international review panels responsible for assessing the consequences of interactions between wild and cultured (farmed) Atlantic salmon and striped bass in Atlantic Canada. In 1998 and 2000, I served on two separate review panels responsible for evaluating the reasons for the decline of Atlantic salmon returning to North American rivers in the 1990s. From 2000 through 2012, I served on the arms-length-from-government committee, COSEWIC (www.cosewic.gc.ca), responsible for assessing the risk of extinction of hundreds of at-risk Canadian species, including Canada's 16 Designatable Units of Atlantic salmon (these are directly analogous to the Distinct Population Segments identified under the U.S. Endangered Species Act). Since 2009, I have co-chaired an international working

group at UC Santa Barbara's National Center for Ecological Analysis and Synthesis on 'red flags' of species endangerment (see www.nceas.ucsb.edu/projects/12559).

3. Through the work and education described above, I have developed expertise in running population models for fish and other endangered species and in evaluating their prospects for recovery. More specifically, I am intimately familiar with the life cycle and life history of Atlantic salmon, and with the various issues relating to the causes of declining Atlantic salmon populations in North America and efforts to bring about their restoration. In a 2002 case, United States Public Interest Research Group v. Atlantic Salmon of Maine and Stolt Sea Farm, in the United States District Court in Maine, I was qualified to testify as an expert on subjects similar to the ones I am testifying about in this case. A current version of my *curriculum vitae* is attached as Exhibit A.

Basis and Summary of Opinions

4. The opinions expressed in paragraphs 6-15, 17-18, and 28 below, and the bases for them, are a more condensed version of the opinions presented in the expert report I prepared for this case in January 2012 ("Hutchings Report" or "Report," a true and correct copy of which is attached as Exhibit B). The citations found in this declaration are to the materials listed in the references section of my Report (Ex. B at 16-18) or, in the case of more recent information obtained since my Report was written, to documents the Plaintiffs are submitting as exhibits.

5. In summary, it is my opinion that:

- Restoration of Atlantic salmon populations in both the Androscoggin and Kennebec Rivers of the Merrymeeting Bay SHRU is fundamentally important to the recovery of the Gulf of Maine Distinct Population Segment ("GOM DPS") of Atlantic salmon;

- Hatchery fish or eggs are necessary, though not sufficient, for the recovery of the Atlantic salmon populations of the Androscoggin and Kennebec Rivers, the Merrymeeting Bay SHRU, and, thus, the recovery of the GOM DPS;

- At current levels of smolt-to-adult death experienced by hatchery-origin smolts that pass by dams during their downstream migration in the GOM DPS, such a population would not increase in abundance and would never recover; both the presence of wild-spawning adults and a reduction in dam-induced mortality are necessary for recovery of the species;

- The mortality experienced by all downstream migrating smolts (both wild- and hatchery-origin) and kelts attributable to dam facilities in the Merrymeeting Bay SHRU (including the four NextEra dams at issue in this case) is having an adverse impact on the survival and the prospects for recovery of the SHRU and, thus, of the GOM DPS as a whole;

- Given (a) the exceedingly low numbers of returning adults to the SHRU, most notably those of wild origin, and (b) the relatively high degree of genetic diversity expected to be represented in the 2013 class of downstream-migrating wild-origin smolts, it is my opinion that the loss of thousands of these migrating smolts – and particularly the loss of any of the small proportion of wild-origin smolts – in the spring of 2013 to turbine-induced mortality at NextEra's dams would have an adverse impact on recovery efforts in this SHRU.

Importance of Androscoggin and Kennebec Rivers to Recovery and Persistence of the DPS

6. The Gulf of Maine Distinct Population Segment (GOM DPS) of Atlantic salmon comprises all sea-run Atlantic salmon whose freshwater range occurs in the watersheds of the Androscoggin River northward along coastal Maine to the Dennys River (Fay et al. 2006). The decision by the Biological Review Team to include the Androscoggin and Kennebec Rivers in the DPS was based on genetic, life-history, and zoogeographic information (Fay et al. 2006). For species recovery purposes, the GOM DPS is partitioned into three Salmon Habitat Recovery Units, or SHRUs. I agree with the conclusion of the federal fisheries services that restoration of viable populations in all three of the 'recovery units' is necessary to both the survival and recovery of the DPS.

7. In my opinion, the restoration of Atlantic salmon populations in the Androscoggin and Kennebec Rivers, which primarily comprise the Merrymeeting Bay SHRU, is fundamentally important to the recovery of the Gulf of Maine DPS of Atlantic salmon. The Androscoggin

River (266 km long) and Kennebec River (373 km long) are among the largest in the GOM DPS and are vital to the recovery and persistence of the DPS. It is well-established that large, complex river systems – such as the Androscoggin and Kennebec Rivers – are capable of supporting large salmon populations (Aas et al. 2011). Based on historical documents, such as those written by Atkins and Foster (1867, 1868), it is highly probable that the Androscoggin, Kennebec, and Penobscot Rivers each once supported adult salmon populations comprising at least 100,000 returning spawning adults.

8. It is also well established that, all else being equal, large populations are less vulnerable than small populations to extinction (*e.g.*, Shaffer 1981; Caughley 1994; Allendorf and Luikart 2007). The greater the number of individuals in a population, the less likely it is that the population will decrease (and the greater the chance that the population will persist) because of: (i) unpredictable environmental changes that similarly affect all individuals (termed 'environmental stochasticity'); (ii) unpredictable environmental changes that affect some but not all individuals (termed 'demographic stochasticity'); and (iii) unpredictable changes in genes and/or gene frequencies, which can lead to inbreeding and the fixation of harmful genes (termed 'genetic stochasticity') (Lande 1988, 1993). Large populations are also less likely to experience an 'Allee effect', which can lead to population decline. An Allee effect exists when population growth rate begins to decline, rather than increase, at a certain 'threshold' level of low abundance (Courchamp et al. 2008). All else being equal, large populations are less likely than small populations to decline to this threshold level of low abundance at which the Allee effect is expressed.

9. Large populations are also of fundamental importance to the recovery of the GOM DPS because of the contributions that large populations make to the persistence of small

populations, such as those that exist in the smaller rivers of the northern coastal part of the DPS. This is because of the ‘straying’ characteristic of salmon populations. That is, when adults return from the ocean to their natal rivers to spawn, ‘errors’ in migration can occur, and some adults (albeit a small percentage, estimated to be 1% for the GOM DPS; Baum 1997) end up spawning in rivers in which they were not born. This straying can be extremely important to the persistence of small salmon populations: the large salmon populations that can be produced by large rivers, such as the Androscoggin, Kennebec, and Penobscot Rivers of the GOM DPS, can provide a ‘rescue effect’ to small populations, thus increasing the chance that population groups, such as the GOM DPS, will persist through time.

10. In addition to their potential for producing large populations of salmon, the inclusion of the Androscoggin and Kennebec Rivers in the GOM DPS provides far greater potential for the ability of the DPS to adapt to future environmental change. This is because of the *increased diversity* that recovered salmon populations in the Merrymeeting Bay SHRU would provide to the DPS as a whole. Diversity is directly related to persistence. The more diverse and variable systems are, the more likely they will persist over time. From a biological perspective, high genetic diversity increases the likelihood of having or producing individuals with genes that will allow adaptation to environmental change, including alterations to habitat or biological community brought about by natural variation and human actions. The relevance of genetic diversity to the 2013 smolt migration in particular is discussed in paragraphs 31-33 below.

11. The federal fisheries agencies have proposed a minimum census abundance of 500 spawners of non-hatchery origin annually for each SHRU, to serve as a “benchmark to evaluate the population as either recovered or one that requires protection under the ESA

[Endangered Species Act]" (NOAA 2009). As noted by NOAA (2009), this benchmark of 500 spawners is consistent with viability criteria established for endangered and threatened salmonid populations elsewhere in the U.S. (Cooney et al. 2007; NMFS 2009). It is worth noting, however, that this benchmark of 500 is less than 1% of the presumed historical spawning population sizes of at least 100,000 for *each* river within the SHRU.

12. It is important that the benchmark of 500 spawners be distributed among all rivers in the Merrymeeting Bay SHRU (*i.e.*, not just the Kennebec) to ensure that the breadth of ecological and environmental conditions that each river's watershed contributes to the process of natural selection in salmon is maintained. It is necessary to maintain this breadth in order to generate the genetic and phenotypic variability within and among salmon populations that is necessary for the Merrymeeting Bay SHRU to contribute positively to the persistence of the GOM DPS.

Importance of Hatchery Fish to Recovery of Merrymeeting Bay SHRU

13. It is my opinion that hatchery fish are necessary — even though far from sufficient — for the recovery of the Merrymeeting Bay SHRU of Atlantic salmon and, thus, the recovery of the GOM DPS. Hatchery fish are likely to be of greatest importance to recovery efforts during the initial years of the recovery program, when population numbers are very low, as they are now. With the exception of the year 2011, fewer than 15 adult fish of wild origin are known to have returned annually to the entire SHRU since 2006. USASAC 2012 (Exhibit 19 to the Declaration of Charles C. Caldart in Support of Plaintiffs' Motion for Preliminary Injunction ("Caldart Dec."). (See my Report, Ex. B at 7, for additional detail on the extremely low current population size.) This is an exceedingly low number of returning adults and places the SHRU at heightened risk of extinction because of the SHRU's increased susceptibility to stochastic,

unpredictable events — anything from droughts to disease to chemical spills — that increase the chance of extinction. *Any measure that increases the chances of survival to the returning-adult stage will reduce the SHRU's probability of extinction.*

14. Because of the genetic and phenotypic differences that exist between hatchery-spawned and/or -reared fish and those that are spawned and reared in the wild (Fraser 2008; Christie et al. 2011), hatchery-origin fish have lower survival rates than wild-origin fish in the GOM DPS (Ex. B at 10-11, Table 2). As concluded by Fraser (2008) in his exhaustive review of the ability of hatchery and captive breeding programs to conserve salmonid biodiversity, "No matter how good the intentions, it would appear that as yet, humans have not generated a group of captive-bred/reared fish that on average will perform equally to wild fish once they are released into the wild." Based on the available data for the GOM DPS, I have estimated that smolts of hatchery origin have less than 25% the rate of survival to the adult stage as smolts of wild origin, and that it likely takes many hundreds of hatchery-origin smolts to produce a single returning adult. Ex. B at 9-11. Nonetheless, hatchery supplementation is capable of increasing the number of spawning adults in the short term, providing a potentially important 'kick start' to the recovery process (Waples et al. 2007; Berejikian et al. 2008). The period of time that constitutes the 'short term' depends on many factors and cannot be articulated precisely for any given situation. In addition, the presence of large numbers of hatchery-origin smolts can provide a 'cover' effect for wild smolts, protecting them from predation. In short, while hatchery-bred fish and eggs can provide an essential supplement to wild salmon populations at the brink of extinction, such as those in the Merrymeeting Bay SHRU, they cannot by themselves bring such populations back to sustainable levels.

15. Data from the salmon populations in the neighboring Penobscot and Narraguagus Rivers, also part of the GOM DPS, is instructive. An Atlantic salmon population that experiences the smolt-to-adult survival rates that have been documented for hatchery-origin smolts in the Penobscot River, which must pass by dams to reach the ocean, will experience negative population growth, meaning that it will decline with time and never recover. Ex. B at 10-11. On the other hand, an Atlantic salmon population that experiences the current levels of smolt-to-adult survival realized by wild-origin smolts in the Narraguagus River, which encounter no dams in their migration to the ocean, would increase with time. Ex. B at 10-11. If the GOM DPS were composed exclusively of hatchery-origin smolts forced to pass multiple dams, that combination would preclude recovery. Both an increase in the numbers of wild-origin salmon, and a decrease in the levels of dam-induced mortality, are likely essential elements for the recovery of the GOM DPS.

Size and Composition of 2013 Smolt Migration

16. Calculating the anticipated size and composition of the 2013 smolt migration requires the following information: survival rates from one life stage to another; the number of years young salmon spend in fresh water before migrating; and the beginning population sizes of wild-spawned eggs and hatchery-stocked eggs, fry, and smolts.

17. In general, the life cycle of Atlantic salmon can be thought of as comprising three stages: (i) egg-to-smolt stage; (ii) smolt-to-spawning-adult stage; (iii) post-spawning stage. The first stage represents the period from the time at which the eggs are released by the female until the time at which the salmon begin their downstream migration to the ocean as smolts (the post-hatching ‘fry’ phase is soon followed by the ‘parr’ phase, in which young Atlantic salmon spend one to three years in fresh water). The second stage represents the period from the beginning of

the smolt migration until the time at which the returning adults are spawning. The third stage represents the ‘kelt’ or ‘previous spawner’ period and extends from the time of initial spawning until the time at which the same individual spawns again. In the GOM DPS, each adult Atlantic salmon female spawning for the first time is estimated to lay 8,500 eggs, while repeat female spawners are estimated to lay 10,000 eggs (USASAC 2011). My analysis assumes returning females are first-time spawners.

18. Estimates of survival between the egg and smolt stages are rare for populations within the GOM DPS, based on the reviews undertaken by Bley and Moring (1988) and by Hutchings and Jones (1998). The only study cited by either review for GOM DPS Atlantic salmon is the work of Meister (1962), who provided an estimate of 1.1% for salmon in Cove Brook, Maine (part of the GOM DPS). Based on egg-to-smolt survival data compiled for 12 rivers worldwide, Hutchings and Jones (1998) reported a median probability of surviving between the egg and smolt phases of 0.0137 (*i.e.*, 1.37%). Restricting the egg-to-smolt survival data to those populations (located in New Brunswick and Québec) nearest to the GOM DPS (Big Salmon River: 0.0017; Miramichi: 0.0047; Pollett: 0.0198; Bec-Scie: 0.0156; Saint-Jean: 0.303; and Trinité: 0.0324), the median egg-to-smolt survival is 0.0177, which is the value I have used in the population modeling in my Report and in my analysis here. This value of 1.77% is well supported by the analysis of egg-to-smolt survival rates in Legault (2004).

19. Atlantic salmon fry soon enter the parr phase. In the GOM DPS, parr are estimated to suffer a 67% mortality rate for each of the one to three years they spend in fresh water before becoming smolts (average of all annual survival estimates during the parr phase reported in Tables 4 and 5 by Legault (2004)).

20. In estimating smolt survival as they pass by dam facilities, I have used the mortality estimates calculated by NextEra itself for each of its dams, as found in the reports NextEra submitted in support of its request for take authorization. Under what it calls "Model C," NextEra generated whole station survival rates based on 48-hour delayed mortality; the turbine-related mortality components of these whole-station figures are derived from a computer model that incorporates site-specific parameters to predict the likelihood of blade strike, which vary from turbine to turbine and from dam to dam. Draft BA at 64 (Caldart Dec. Ex. 3); Revised Draft "Habitat Conservation Plan For Atlantic Salmon, Shortnose Sturgeon and Atlantic Sturgeon at the Lockwood, Shawmut, Weston, Brunswick and Lewiston Falls Hydropower Projects on the Kennebec and Androscoggin Rivers, Maine," Sections 4-8 ("HCP §4-8"), Joint Record Exhibit 7 (ECF No. 79-1) at 11, Table 4.2-4, Model C (PageID#1333). The bypass-related and spill-related mortality components of these whole station survival figures (bypass and spill are the only means of passage if the turbines are shut down) are the same for each dam: 3.7%, or 96.3% survival. HCP §4-8, at 10 [79-1] (PageID#1332). These rates are shown in the following table:

Table 1. Estimated Rates of Whole Station Smolt Survival

Dam	**48-Hr. Whole Station Survival Rate, Including Turbine Mortality (Model C)**	**48-Hr. Whole Station Survival Rate For Spill & Bypass Routes Only**
Weston	90%	96.3%
Shawmut	90%	96.3%
Lockwood	92%	96.3%
Brunswick	93%	96.3%

21. The mortality rates listed in Table 1 likely understate actual levels of smolt mortality. It is my opinion that a whole station survival model that accounts for delayed mortality caused by initial injury produces the most defensible mortality estimates for Atlantic salmon smolts among those available, and 48 hours is an insufficient amount of time to fully account for delayed mortality. An initial injury rate model is most appropriate because of the extreme physical vulnerability, or fragility, of salmon undergoing smoltification (the significant bodily changes that acclimate the fish to salt water). The types of injuries caused by NextEra's turbines and other dam structures include scale loss, gill damage, severed body/backbone, and bruised head or body (NextEra 2011), all of which can be expected to result in significantly increased likelihood of death. Furthermore, Plaintiffs' expert Randy Bailey has pointed to (a) a number of additional ways in which NextEra may have underestimated whole station mortality rates (particularly turbine mortality rates), and (b) the fact that a 2012 study found actual smolt mortality resulting from passage of the four Kennebec dams (NextEra's three, plus Hydro Kennebec) at levels exceeding NextEra's estimates, despite recent improvements to some bypass facilities.

22. The 2013 smolts will be comprised of individuals aged 1, 2, and 3 years old. An estimated 90% of the smolts in 2013 will be 2 years old and will have originated from: (i) eggs spawned naturally in 2010 by returning wild-origin and hatchery-origin adults; (ii) hatchery-origin eggs stocked in 2010 (in the Sandy River, a tributary of the Kennebec River, only); and (iii) hatchery-origin fry stocked in 2011. The remaining 10% of 2013 smolts will have originated from eggs produced in 2009 and fry stocked in 2010 (migrating in 2013 as 3-yr-old smolts) and from eggs produced in 2011 and fry stocked in 2012 (migrating in 2013 as 1-yr-old smolts). In the absence of age composition data for smolts in the Kennebec and Androscoggin Rivers, it is

assumed that 1- and 3-yr-old smolts comprise 5% of the smolt migration in each river. In support of this assumption, USASAC identifies the average age composition of smolts in the Sheepscot River (a river of the Merrymeeting Bay SHRU) to have been 5% 1-yr-olds, 90% 2-yr-olds, and 5% 3-yr-olds from 2005 through 2009. USASAC 2011, Table 5.4.3 (Caldart Dec. Ex. 19).

23. Using published information about adult returns and hatchery stocking efforts from 2009 through 2011 (KHDG 2012 (egg stocking) and USASAC 2012 (fry stocking and adult returns), Caldart Dec. Exs. 20 and 19, respectively), I estimate the number of salmon reaching the smolt developmental stage in the Kennebec and Androscoggin Rivers in the spring of 2013 will be 19,762 and 964, respectively. This information is summarized in Table 2:

Table 2. Estimated number of 1-, 2-, and 3-year-old smolts produced in 2013 in the Kennebec and Androscoggin Rivers (including associated calculations and assumptions).

KENNEBEC					
Year eggs were spawned or stocked	**2009**	**2010**	**2011**	**Assumptions**	**Total Smolts Produced**
Stocked eggs	166,494	599,849	859,893		
Eggs spawned by wild adults	46,750	12,750	182,750	8,500 eggs × no. of females (half no. of returning adults)	
Eggs spawned by hatchery adults	93,500	8,500	89,250	8,500 eggs × no. of females (half no. of returning adults)	
Total eggs	306,744	621,099	1,131,893		
Smolts produced from eggs	**271** (calculation: 306,744 * 0.05 * 0.0177 = 271)	**9,894** (621,099 * 0.9 * 0.0177 = 9,894)	**1,002** (1,131,893 * 0.05 * 0.0177 = 1,002)	Egg-to-smolt survival rate is 0.0177. 90% of smolts aged 2 years; 5% of smolts aged 1 and 3 years.	**11,167**
Year fry were stocked	**2010**	**2011**	**2012**		
Stocked fry	147,000	85,000	Not known		
Smolts produced from stocked fry	**264** (calculation: 147,000 * 0.05 * 0.33 * 0.33 * 0.33 = 264)	**8,331** (85,000 * 0.9 * 0.33 * 0.33 = 8,331)	Not known	Annual parr survival rate is 0.33. 90% of smolts aged 2 years; 5% of smolts aged 1 and 3 years	**8,595**
Total smolts produced (from eggs and stocked fry)	**535**	**18,225**	**1,002**		**19,762**

ANDROSCOGGIN					
Year eggs were spawned or stocked	**2009**	**2010**	**2011**	**Assumptions**	**Total Smolts Produced**
Stocked eggs	0	0	0		
Eggs spawned by wild adults	12,750	8,500	63,750	8,500 eggs per female × 0.5 no. returning adults	
Eggs spawned by hatchery adults	89,250	29,750	123,250	8,500 eggs per female × 0.5 no. returning adults	
Total eggs	102,000	38,250	187,000		
Smolts produced from eggs	**90** (calculation: 102,000 * 0.05 * 0.0177 = 90)	**609** (calculation: 38,250 * 0.9 * 0.0177 = 609)	**165** (calculation 187,000 * 0.05 * 0.0177 = 165)	Egg-to-smolt survival rate is 0.0177. 90% of smolts aged 2 years; 5% of smolts aged 1 and 3 years.	**864**
Year fry were stocked	**2010**	**2011**	**2012**		
Stocked fry	1,000	1,000	Not known		
Smolts produced from stocked fry	**2** (calculation: 1,000 * 0.05 * 0.33 * 0.33 * 0.33 = 2)	**98** (calculation: 1,000 * 0.9 * 0.33 * 0.33 = 98)	Not known	Annual parr survival rate is 0.33. 90% of smolts aged 2 years; 5% of smolts aged 1 and 3 years	**100**
Total smolts produced (from eggs and stocked fry)	**92**	**707**	**165**		**964**

Dam-Induced Mortality for 2013 Smolt Migration

24. For purposes of the analysis below, the number of smolts forecast to reach the sea, out of the population of 2013 migrants calculated above, is assumed to depend entirely on their probability of surviving the passage of dams in each river. NMFS estimates that natural sources

of smolt mortality account for only 0.002% mortality per kilometer traveled (NMFS, "Hydro Kennebec Biological Opinion," at 60; Caldart Dec. Ex. 5), which (a) is several orders of magnitude less than dam-induced mortality, (b) would produce less than 1% additional mortality for this migration, and (c) would not affect my conclusions about the impacts of dam-induced mortality because smolts would experience this natural mortality regardless of the presence of dams.

25. The smolts migrating down the Kennebec River from their spawning grounds must pass four dams (Weston, Shawmut, and Lockwood, owned by NextEra; and Hydro-Kennebec), and the smolts migrating from spawning grounds in the Androscoggin or its tributaries must pass at least one dam (Brunswick, owned by NextEra) and as many as three (Pejepscot and Worumbo as well). Three of the dams on the Kennebec River are potentially affected by Plaintiffs' request for a preliminary injunction shutting down turbines and one of the dams on the Androscoggin is potentially affected.

26. For the reasons described in paragraph 20 and Table 1, above, it is assumed that the probability of surviving the passage of each of NextEra's Kennebec River dams is as follows: 90% survival rate at Weston, 90% at Shawmut, and 92% at Lockwood (again, actual mortality is likely greater; see paragraph 21 above). It is assumed that the probability of surviving passage of Hydro Kennebec dam is 92.1%, the figure cited in the Biological Opinion for that dam. Hydro Kennebec Biological Opinion at 60. In 2013, given the number of expected smolts and these dam-induced mortality rates, the four dams on the Kennebec River are predicted to kill 6,199 smolts under current operating conditions, or 31.4% of the entire 2013 run of 19,762 smolts. If the probability of surviving passage at NextEra's three Kennebec River dams were increased to

96.3% by eliminating turbine-induced mortality, that would enable an additional 2,691 smolts, or 13.6% of the smolt run, to reach the sea in 2013. This analysis is summarized in Table 3, below.

27. For the reasons described in paragraph 20 and Table 1, above, it is assumed that the probability of surviving the passage of NextEra's Brunswick dam on the Androscoggin River dams is 93% (again, actual mortality is likely greater; see paragraph 21 above). It is assumed that the probability of surviving passage of Pejepscot dam (the next upstream dam that is situated below likely spawning grounds) is 91.6%, the figure cited in the Biological Opinion for that dam. (NMFS, "Pejepscot Project Biological Opinion," at 59; Caldart Dec. Ex. 22). In 2013, given the number of expected smolts and these dam-induced mortality rates, if one assumes that these smolts must pass at least the two lower-most dams on the Androscoggin River, those dams are predicted to kill 143 smolts, or 14.8% of the already extremely small 2013 run of 964 smolts. If the probability of surviving passage at NextEra's Brunswick dam were increased to 96.3% by eliminating turbine-induced mortality, that would enable an additional 29 smolts, or 3% of the smolt run, to reach the sea in 2013. This analysis is summarized in Table 3, below.

Table 3. Estimated dam-induced mortality for 2013 smolt migration, with and without turbine shutdowns.

Kennebec River Dams	**Under Current Operating Conditions**	**With Turbine Shutdown at NextEra Dams**
Starting Smolt Population	19,762	19,762
Weston	19,762 x 90% survival = 17,786	19,762 x 96.3% survival = 19,031
Shawmut	17,786 x 90% survival = 16,007	19,031 x 96.3% survival = 18,327
Hydro-Kennebec	16,007 x 92.1% survival = 14,742	18,327 x 92.1% survival = 16,879
Lockwood	14,742 x 92% survival = 13,548	16,879 x 96.3% survival = 16,254
Smolts Surviving Dam Passage	13,563	16,254
Smolts Killed by Dams	**6,199**	**3,508**
Androscoggin River Dams	**Under Current Operating Conditions**	**With Turbine Shutdown at NextEra Dam**
Starting Smolt Population	964	964
Pejepscot	964 x 91.6% survival = 883	964 x 91.6% survival = 883
Brunswick	883 x 93% survival = 821	883 x 96.3% survival = 850
Smolts Surviving Dam Passage	821	850
Smolts Killed by Dams	**143**	**114**

Turbine-Induced Mortality in Spring 2013 Will Have Significant Adverse Impacts

28. In preparing my expert Report for this case, I analyzed the impact over time of dam-induced mortality to downstream-migrating salmon smolts and kelts on the prospects for,

and timing of, recovery of the Merrymeeting Bay SHRU. Ex. B at 12-16. Using a well accepted model for population growth (or decline), I estimated recovery times for the Merrymeeting Bay SHRU under different smolt-to-adult survival scenarios and starting population sizes. The results of my analysis indicate that the presence of multiple hydropower dams on the Kennebec and the Androscoggin very significantly increases, by decades or even centuries, the time required to achieve the benchmark of 500 wild spawners annually in the Merrymeeting Bay SHRU. The risk of such greatly extended recovery times — and the reason one would want to reduce recovery time — is that the longer a population exists near the brink of extinction, the more likely it is that one or more stochastic, unpredictable events will occur which might significantly increase the chance of extinction of the SHRU.

29. With that analysis as context, I consider here the impacts of dam-induced mortality resulting from a single smolt migration season. For a number of reasons, some of which are particular to the 2013 year class of smolts, it is my opinion that the loss of thousands of these migrating smolts – and particularly the loss of any of the small proportion of wild-origin smolts – in the spring of 2013 to turbine-induced mortality would have an adverse impact on recovery efforts in the Merrymeeting Bay SHRU. Averting nearly half of those mortalities (nearly 3,000 smolts, or more if NextEra's mortality estimates understate actual mortality rates) through turbine shutdowns would significantly lessen that adverse impact.

30. First, it is fundamentally important to the recovery of the GOM DPS that as many wild-origin smolts be preserved as possible in the Kennebec and Androscoggin Rivers. As has been demonstrated elsewhere (e.g., recovery efforts in 32 rivers of the Inner Bay of Fundy in New Brunswick and Nova Scotia; see http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_Atlantic%20Salmon_2011_e.pdf), the

successful recovery of depleted Atlantic salmon will not occur in the absence of wild-origin adults.

31. Second, this 2013 class of migrating smolts will be uniquely important, in that an unusually high amount of genetic diversity will be represented in its wild-origin smolts. The 2013 wild-origin smolts represent the product of those wild-origin spawners that returned to the Kennebec and Androscoggin Rivers in 2009, 2010, and 2011 (a wild-origin spawner is defined here to be a spawner of non-hatchery origin, *i.e.*, the type of spawner upon which NMFS's target of 500 returning adults for the Merrymeeting Bay SHRU is based). The total number of adult wild-origin salmon returning to the Kennebec and Androscoggin Rivers during these three years was 57 and 20, respectively. When compared to past smolt runs for which data is available, the total number of wild-origin adults contributing to the 2013 smolt run in these two rivers (n=57+20=77) is almost *three times* that of the next highest number. The previous maximum (n=28) produced the 2011 smolt run (19 wild-origin adults in the Kennebec River and 9 wild-origin adults in the Androscoggin River, from returns in 2007, 2008, and 2009); the 2010 smolt run arose from only 19 wild adults. USASAC 2012 at Appendix 16 (Caldart Dec. Ex. 19).

32. Given that each individual adult salmon is genetically different from every other, the greater the number of spawning adults the greater their collective genetic diversity. This means that the genetic variation upon which the 2013 smolt run is based will almost certainly be greater – perhaps dramatically greater – than that of any previous smolt run in decades in the two rivers combined. And as a result, the genetic variability of their offspring, the 2013 wild-origin smolts, is forecast to also be greater than that of previous runs.

33. Because of the fundamental importance to recovery of having as genetically variable a smolt run as possible, the 2013 smolt run stands out as the most important in decades.

In other words, these wild-origin smolts are irreplaceable; the loss of the genetic material they carry would be a setback to recovery that cannot be recovered. The more of them that are killed, the greater the loss. The fundamental importance of genetic variability to the recovery and persistence of endangered populations is firmly established in the scientific literature, e.g., Lande (1988), Allendorf and Luikart (2007), Fraser (2008). As noted in the 2009 draft of the Gulf of Maine Distinct Population Segment Management Guidance for Recovery (NOAA 2009), genetic variability "is necessary in ensuring that [a] population is capable of adapting to and surviving natural environmental and demographic variation that all populations are subjected to over time."

34. Third, given that we are unable to predict the dates upon which wild-origin smolts will migrate, and given that turbines do not discriminate between wild-origin and hatchery-origin smolts, it is necessary to ensure that all smolts are protected from turbine mortality during the entire downstream migration period.

35. Fourth, in 2013 more smolts will have been produced from stocked hatchery-origin eggs than in any previous year. Importantly, the estimated number of smolts originating from the Sandy River (tributary of the Kennebec River) in 2013 is 19,762, far more than the 13,892 estimated to have been produced in 2012 (Maine Department of Marine Resources, cited in Hydro Kennebec Biological Opinion at 60). Killing off over 30% of migrating smolts on the Kennebec this year would wipe out much of the potential short-term 'kick-start' benefit of producing any return spawners from Maine's expanded hatchery stocking program.

36. Fifth, the greater the total number of smolts, irrespective of origin, the greater the protection afforded to wild-origin smolts from predation. Thus, the more the migrating population is "culled" by dam-induced mortality, the greater the likelihood that any wild smolts that survive dam passage will be picked off by predators.

37. Sixth, although very few adults returned to spawn in 2012, the loss of any downstream-migrating kelts to turbine mortality in 2013 would constitute a significant loss. It is reasonable to hypothesize that previously spawned fish, which migrate downstream to the sea as kelts, represent genotypes that are well-adapted to current local conditions, given that they survived to spawn. And if they are able to make it back to the sea, they may return to spawn again. Repeat spawning females in the GOM DPS are estimated to produce 10,000 eggs each, further emphasizing the importance of safe downstream passage for kelts.

I declare under penalty of perjury, this 12th day of March, 2013, that the foregoing is true and correct.

/s/ Jeffrey A. Hutchings
Jeffrey A. Hutchings

CERTIFICATE OF SERVICE

I hereby certify that on the 14th day of March 2013, I electronically filed the above *DECLARATION OF DR. JEFFREY A. HUTCHINGS IN SUPPORT OF PLAINTIFFS' MOTION FOR PRELIMINARY INJUNCTION* on behalf of the above-named Plaintiffs, with the Clerk of Court, using the CM/ECF system, which will send notification of such filings to all other counsel of record.

/s/ Rachel Gore Freed
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